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SPACE DOMINANCE

CAN THE AIR FORCE CONTROL SPACE?

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by

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The Air Force, as part of its vision for the 21st century, has declared Space Dominance and Space Control as new military objectives. It is not clear if the Air Force understands the difficulties associated with dominating the space environment, but several issues have yet to be resolved. While the requirements for achieving space control are numerous, three stand out as especially critical: sound doctrine, viable technology, and political resolve. Doctrine provides our basis for employing forces and waging war. Without strong space doctrine, space control will likely meet with less than successful results. Technology is the linchpin which allows space operations to be achievable and effective. Without the required technology, space control is impossible. Politics is the last and most critical requirement in achieving space control. Neither doctrine nor technology can compensate for the lack of political resolve. Without it, all other efforts are futile. This paper discusses the doctrinal, technical and political difficulties of achieving space control as well as other issues which complicate the space control mission. Based on the analysis of these elements, a determination is made as to the feasibility of effectively implementing a space control policy.

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Preface

This paper is intended to stimulate discussion as to the difficulties associated with controlling outer space. Since the beginnings of space exploration, outer space has been intended to be the property of all nations and to be used for only peaceful purposes. This concept even survived through the cold war years. Neither the US nor the Former Soviet Union weaponized space or espoused an official policy of space control. In this changing world environment, could the US policy of space control be construed as a rebirth of American imperialism? Should the US pursue a space control policy? If we do, are we willing to accept the economic and political sacrifices that are required? These questions are designed to stimulate discussion and determine whether space control is in the best interest of the United States.

Abstract

The Air Force, as part of its vision for the 21st century, has declared Space Dominance and Space Control as new military objectives. It is not clear if the Air Force understands the difficulties associated with dominating the space environment, but several issues have yet to be resolved.

While the requirements for achieving space control are numerous, three stand out as especially critical: sound doctrine, viable technology, and political resolve. Doctrine provides our basis for employing forces and waging war. Without strong space doctrine, space control will likely meet with less than successful results. Technology is the linchpin which allows space operations to be achievable and effective. Without the required technology, space control is impossible. Politics is the last and most critical requirement in achieving space control. Neither doctrine nor technology can compensate for the lack of political resolve. Without it, all other efforts are futile.

This paper discusses the doctrinal, technical and political difficulties of achieving space control as well as other issues which complicate the space control mission. Based on the analysis of these elements, a determination is made as to the feasibility of effectively implementing a space control policy.

Chapter 1

Introduction

> *We are entering, or perhaps have already entered, an era in which the use of space will exert such profound influence on human affairs that no nation will be fully able to control its own destiny without significant space capabilities.*
>
> —General Robert T. Herres (USAF)
> Vice Chairman of the JCS, 1988

From the earliest days of armed conflict, military forces have endeavored to occupy the "high ground" of the battlefield. This "high ground", whether it be a hill, a mountain, the air, or space, has always given the occupying force an advantage over his adversary. As a result, most successful armies have sought to find and control this "high ground". As technology advanced, the definition of the "high ground" changed. With the advent of the airplane, air became the new high ground and air superiority the rallying cry. Today, technology has advanced to where space is the high ground of the 21st century and space superiority its new rallying cry.

Since the mid-to-late 1950's, space has been an integral part of military planning, strategy, and operations. In just four decades, our reliance on space has gone from speculative interest to vital necessity. While space has been in the public eye since the early days of Sputnik and Explorer, its application as a military force multiplier was not

seen until the Gulf War. With the success of space systems during Desert Storm, a new emphasis has been placed on space assets and control of the space environment.

The United States, in an effort to take advantage of this new medium, has developed political and military policies with the objective of gaining and maintaining dominance in space. In support of these policies, Air Force Chief of Staff Ronald R. Fogleman has released his vision of the Air Force's role in the next century. Titled "Global Engagement: A Vision for the 21st Century Air Force", this new policy updates the list of Air Force areas of expertise or "core competencies".[1] These new core competencies have placed a significant emphasis on the development of space power, with the first core competency being "air and space superiority".[2] Secretary of the Air Force, Sheila Widnall, in referring to this new vision, stated that, "Global Engagement" calls for the Air Force to "make the transition to an air and space force and ultimately to a space and air force."[3] This new emphasis on space power is also reflected in the Air Force's basic doctrine.

AFM 1-1

Air Force Manual 1-1 (AFM 1-1): Basic Aerospace Doctrine of the United States Air Force has outlined "aerospace control" as one of the roles and missions associated with the core competency of air and space superiority.[4] Aerospace control requires the Air Force to gain and maintain dominance of both air and space. While control of the air has been fairly well defined in terms of air superiority and air supremacy, control of space has not. Air supremacy was demonstrated in the Gulf War with its resulting advantages and benefits readily observable. Space control, on the other hand, has been more elusive. The benefits of controlling space are obvious, but the methods to achieve it are not. With

the increasing number of actors involved in the development of space, control of it has become an increasingly complex issue. The complexity arises in defining control. Is it simply air superiority or supremacy as it applies to space? If not, what is it? Is total space control achievable, and what is the Air Force plan to gain and maintain dominance in space both now and for the future? This paper will address the key question: Can the Air Force achieve space dominance/control? In answering this question, a number of complex issues must be addressed. First, the current US policy towards space and the doctrine which supports it will be analyzed to determine how it supports space control. Second, both current and future technologies will be evaluated to determine if the technology base exists to achieve space control. Third, the political environment will be assessed to determine if the political resolve required to achieve space control truly exists. And finally, a number of complex issues will be addressed which show the difficulties associated with declaring space dominance/control an Air Force objective. These basic questions must be defined and answered before a determination can be made on the viability of achieving space control.

Overview

Since the late 1950s, the United States has sought to exploit the benefits of space. Originally engaged in a "race for space" with the Soviet Union, both countries pursued a peaceful space policy of development and exploration. The Soviet Union launched Sputnik I, the first man-made satellite, on 4 October 1957.[5] The US followed suit shortly after by launching Explorer I on 31 January 1958.[6] While the development of both

countries' space programs remained relatively peaceful, the potential military benefits of controlling space were well known.

The US-USSR competition for dominance in space continued through the cold war years with each striving to outdo the other. While the Soviets were first in sending a man into space, the US was first to land a man on the moon and demonstrate the concept of a reusable launch vehicle (i.e. the Shuttle Program). Through the 1960's, the space race became ever more aggressive in nature. The advent of the intercontinental ballistic missile (ICBM) and the fear of nuclear war spelled the end of the peaceful development of space and marked the beginning of its gradual militarization.

As both countries continued to counter the other's capabilities, a technological revolution in space was born. The satellite technologies developed by both sides during this period included high resolution photographic reconnaissance, secure communications, electronic intelligence, early warning, and navigation. In the early years, both countries concentrated on developing anti-ballistic missile (ABM) defense as well as anti-satellite (ASAT) capabilities. These technologies, however, were considered destabilizing to nuclear deterrence and the ABM Treaty was signed by both countries in 1972, limiting the development and deployment of such systems.[7] While the US has never deployed an active ASAT system, significant resources have been expended in the research and development of technologies which could provide such a capability. The US, under the Reagan Administration, funded the Strategic Defense Initiative program. Dubbed by the media as "star wars", this program actively researched and developed prototypes of directed energy and kinetic energy weapons systems which might be used in an ABM or ASAT role.[8] Kinetic energy weapons and directed energy weapons research included earth

based, air based and space based lasers, particle beams, and kinetic kill vehicles.[9] While none of these systems were ever deployed, many of the technologies were proven feasible. The effort in these areas continued at full pace until the collapse of the Soviet Union in 1991.

Space Control: Why Do We Need It?

Since the early days of the space race, the US has realized the advantage that comes with controlling the heavens. General Thomas D. White, then Air Force Chief of Staff, was quoted in 1957 as saying "in the future, whoever has the capability to control space, will likewise possess the capability to exert control of the surface of the earth."[10] This prophetic statement was fully realized nearly 35 years later in the desert of the Middle East. The Gulf War made perfectly clear the advantage space gives the controlling party. Touted by some as the first "Space War", the use of space based communications, reconnaissance, and navigation greatly enhanced the coalition forces' ability to prosecute the war. While the US use of space was never contested, it is unlikely that future conflicts will be waged against enemies with such limited space capability. Each year, the technological margin the US has over the rest of the world is eroded. Future conflicts will likely involve nations with significant space capability.

The importance space will play in future conflicts can not be over-emphasized. Just as the US has become increasingly dependent, both militarily and economically, on the use of space, the remainder of the world has begun to experience the same phenomenon. The US and USSR no longer hold a monopoly on space exploration and development. A number of nations now have from limited to advanced space capabilities. Future space

control will depend on our adversary's capabilities in space. Just as air superiority can be achieved against an inferior enemy air force, space superiority can likewise be achieved against an inferior enemy space force. In the past, the US has counted on this inferiority to maintain dominance in space. With the technological margin rapidly fading, the US can no longer accept as default its superiority in space capability. Sophisticated enemies with the capability to use space to their advantage will continue to emerge. To counter such threats, the US must continue to lead the advance in space technology, for only by controlling the "high ground" of space, can the US ensure its own security and freedom of action around the world.

Space Control Requirements

While the requirements to achieve space control are numerous, three stand out as especially critical: sound doctrine, viable technology, and political will. Sound doctrine "is what warriors believe in and act on."[11] It provides the basis for how we employ forces and wage war. Just as sound air power doctrine is needed to effectively employ air forces, sound space doctrine is needed to effectively employ space forces. Without strong space doctrine, implementing space control will likely meet with less than successful results.

Technology is a binary function; it either exists or it doesn't. Without it, nothing is possible. With it, anything is possible. Technology is the linchpin which allows space operations to be achievable and effective. Without the technology to develop and employ the systems required for space dominance, no effective space control policy can ever be instituted. Just as air superiority requires advanced aircraft and weapons systems, space control requires advanced spacecraft and space systems. So, does the technology to

support a policy of space control exist? If it doesn't, space control is impossible. If it does, the question is no longer whether it's possible, but rather, is it feasible?

Politics is the last and most critical requirement in achieving space control. Even the most sound doctrine and advanced technology become useless without the political will to use them. Political will can be nebulous and highly unpredictable. It did not exist in North Vietnam, but it did exist in the Persian Gulf. As for space, whatever the advances in technology and doctrine, the political support and will to employ forces is crucial to space control. Without the political will to implement a policy of space control, all other efforts are futile.

Notes

[1] Julie Bird, *The Long Range Forecast*, Air Force Times, 57th year, No. 18, 2 Dec 1996.

[2] Ibid.

[3] Ibid.

[4] Department of the Air Force, *AFM 1-1: Basic Aerospace Doctrine of the United States Air Force*, March 1992, 6.

[5] Steven R. Peterson, *Space Control and the Role of Antisatellite Weapons* (Maxwell Air Force Base, AL: Air University Press, 1991), 3.

[6] Ibid.

[7] *Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitations of Anti-Ballistic Missile Systems*, Signed 26 May 1972, Entered into force 3 October 1972.

[8] Joyce E. Larson and William C. Bodie, *The Intelligent Layperson's Guide to "Star Wars"* (New York, NY: National Strategy Information Center, Inc., 1986), 7.

[9] Harry Waldman, *The Dictionary of SDI* (Wilmington, DE: Scholarly Resources Inc., 1988), 107,128,129.

[10] Richard P. Davenport, *Strategies for Space: Past, Present and Future* (Newport, RI: Naval War College, 1988), 1.

[11] Department of Defense, *Joint Pub 1: Joint Warfare of the Armed Forces of the United States*, 10 January 1995, I-3.

Chapter 2

Doctrine

> *At the very heart of war lies doctrine. It represents the central beliefs for waging war in order to achieve victory.…It is the building material for strategy. It is fundamental to sound judgment.*
>
> —General Curtis E. Lemay, USAF, 1968

Doctrine, as expressed by General Lemay, "represents the central beliefs for waging war".[1] It provides the foundation, the building blocks for how we train and employ forces. In essence, it is the playbook for military operations. It defines how the military, in a joint effort, "intends to conduct war and operations other than war." It must be "...definitive enough to guide specific operations, yet remain adaptable enough to address diverse and varied situations worldwide."[2] Without doctrine, the military instrument of power cannot effectively and coherently be employed.

Sound doctrine must take into account a number of complex and continually changing issues. It must not only address the current strategic environment, but must also serve as the voice of experience. It must take into account the political, technical, and economic environment, as well as, incorporating lessons learned, both good and bad, from past military operations. Doctrine is "what history has taught us works in war, as well as what does not."[3] It is "...the accurate analysis and interpretation of history".[4]

Because experience plays such a large role in the development of doctrine, obvious problems arise when such experience is lacking. Space doctrine is just such a case. Currently, there is virtually no published space doctrine. Much of the reason is the lack of operational space experience. While space operations have been conducted since the late 1950's, no hostilities have ever occurred in space. This lack of experience makes it difficult for the military to accurately assess how hostile operations in space would be carried out. Without this experience, doctrine developed for domination or control of space must be based on theory and not practical experience.

Space Doctrine

AFM 1-1, the Air Force's first attempt at space doctrine, compensates for the lack of space experience by relying on its wealth of airpower experience. Considering air and space part of an "indivisible whole", with space an extension of the air above it, AFM 1-1 has integrated the two into one environment; the aerospace environment. By making the assumption that "..the same basic military activities can be performed in each..", AFM 1-1 implies that space dominance can be achieved using the same principles as air dominance.[5] Whether this theory is an accurate reflection of reality, only time and experience will tell. Because doctrine provides the basis for our fundamental way of fighting, it must be based on sound and achievable principles taking into account all contextual and operational elements. Inaccurate assumptions made in the development of doctrine significantly complicates the employment of military forces. Faulty doctrine creates more problems than solutions. As General Henry H. ("Hap") Arnold was quoted as saying "...any Air Force which does not keep its doctrines ahead of its equipment, and its visions far into the

future, can only delude the nation into a false sense of security."[6] Thus, correlating space operations to air operations may be extremely insightful, or, the phrase "aerospace control" may go down in history with the same infamy as "the bomber will always get through."

Space Control

The words, "Space Control", are rapidly becoming the catch-phrase of the 21st century military. Cited in numerous documents ranging from doctrine to policy, it is often used but rarely defined. To understand the complexity associated with space control, a working definition must be developed.

Definition

Control, as defined in Webster's dictionary, is the "authority or ability to regulate, direct, or dominate." To relate this to space, one could simply rephrase it to state, space control is the "authority or ability to regulate, direct, or dominate space". A more basic definition is set forth by AFM 1-1 which states, "aerospace control assures the friendly use of the aerospace environment while denying its use to an enemy. [It] includes all missions whose objectives are designed to gain and maintain control of the aerospace environment." These two definitions are similar in that both require "dominating" the environment, and "denying" or "regulating" its use by the enemy.[7] It is here that the link (not always correct) is made between air and space. Because air dominance has been well established and defined, it is assumed that space dominance is likewise defined. Space control is therefore thought to be simply an extension of air superiority. Space, however, has numerous unique characteristics and requirements, both political and technical, which

make it distinctively different from air. These differences drastically change the method and viability of implementing space control operations. The next section will look at the differences which exist between air and space as well as the missions required to attain the denial and domination necessary for space control.

Air Superiority vs. Space Superiority

A major fallacy of AFM 1-1 is the assumption that air and space constitute a single medium. Classified as the "aerospace" environment, AFM 1-1 presumes air and space to be parts of an "...indivisible whole..." This assumption has resulted in the development of "aerospace doctrine". Based almost solely in airpower doctrine, it ties space operations to airpower principles. This faulty association is the basis for the mission of "aerospace control". It presumes space control can be achieved using the same doctrine, principles, and tactics as that used to achieve air superiority.

Contrary to AFM 1-1, space is not merely "a continuum (of air) that extends upward toward infinity." Space, and the systems which operate in it, have vastly different characteristics than those which operate in air. Many of these characteristics are ruled by the laws of physics, others by the laws of man. Several examples will clarify these differences.

Space has no legal boundaries. While nations do recognize the political boundaries of air, no such boundaries exist for space. A satellite may orbit continuously over another nation without its permission, while only several miles lower, an aircraft must receive authorization to fly through the airspace.

Gravity. Gravity plays a critical role in the operation of both aircraft and spacecraft. Aircraft require fuel to produce the energy needed to operate in a gravity environment.

This necessitates the inconvenience of landing when fuel is expended. Spacecraft, on the other hand, expend all their fuel in breaking free of the earth's gravitation field. Once in orbit, they can operate continuously with little to no fuel consumption.

Maneuverability. Aircraft, through the science of aerodynamics, are highly maneuverable and extremely flexible. They can be used at a moment's notice, taking an infinite number of paths to their target. This gives aircraft the added benefit of unpredictability. Spacecraft, however, lack maneuverability and flexibility. Due to the laws of orbital mechanics, space systems require large quantities of fuel for small changes in orbital trajectory. Because space systems use the majority of their fuel in achieving orbit, limited fuel makes changing orbital trajectories rare. This reduces their flexibility and increases their predictability. Predictability is one of the most critical vulnerabilities of space systems.

Accessibility: Aircraft systems, being earth based, are readily accessible. With hands-on access, they can easily be repaired, modified, or upgraded. They are inexpensive, in relation to space systems, and can easily be replaced when damaged or destroyed. Space systems, however, can be difficult or impossible to repair. They are extremely expensive and are often prototype systems. Also, launch capabilities have not advanced to the point where damaged, destroyed, or obsolete systems can be reliably replaced without long delays.

Understanding these differences is critical to evaluating the acceptability of current aerospace doctrine. Because doctrine guides our military strategy, faulty doctrine leads to faulty strategy. A determination must be made whether space doctrine, based solely on airpower doctrine, is adequate, or whether independent space doctrine must be developed.

Elements of Space Control

Space control can be divided into three elements: surveillance, protection, and negation.[8] Surveillance provides the capability to detect, track, and identify both launched and orbiting objects as well as determining their capability to threaten friendly systems. Protection allows friendly space systems to safely operate while the enemy attempts to deceive, disrupt, or destroy them, and negation denies the enemy the ability to effectively use space. Of these three, protection and negation are the most lacking US space capabilities.[9]

For years, the US has concentrated on its surveillance systems. These systems have provided the foundation for the US presence in space. While surveillance will remain important, effective space control must also focus on protection and negation. The three elements, surveillance, protection, and negation, form a triad; each system equally dependent on the others. Surveillance being the eyes, protection the shield, and negation the weapon. A weakness in any element impacts the overall ability to effectively control space. The US must therefore consider the development of protection and negation systems a priority if space control is to be achieved.

Space Protection and Negation

Space protection and negation together make up the defense and offense of space control. Both rely on the ability to damage, deceive, or destroy enemy satellites in either a defensive or offensive mode. While some protection and negation exists through passive and conventional earth based systems, the US is seriously lacking any effective ground based, air based, or space based anti-satellite capability.

To develop the protection and negation capabilities necessary for effective space control, the US must make the hard decision to weaponize space. While much of the decision to limit space weapons lies with the political establishment, ASAT weapons are essential in denying the enemy the use of space. Only ASAT weapons provide the advantage needed to dominate the space environment. Without a well supported ASAT program, protection and negation can never be completely effective. Without protection and negation, space control can not be fully realized.

Weaponizing Space

The decision to weaponize space is the true roadblock to achieving effective space control. Much like the employment of nuclear weapons, space weapons serve two purposes. In times of peace, they serve as a deterrent to conflict. Should deterrence fail, they are employed during hostilities to gain control of the environment. While weaponizing space may be the militarily sound decision, it carries with it numerous political ramifications. Since the beginning of space exploration, the US has supported a policy of equal access to space. Even today, our National Space Policy states that, "the United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all humanity."[10] While the policy does support the use of space for national defense and security, placing weapons in space, orbiting other sovereign nations, does not appear to meet the intent of the policy.

Much of the political difficulty in deploying space weapons is in their dual use capability. A high-power laser, used for the stated purpose of defense, could also be used as a first strike offensive weapon. Additionally, lasers and kinetic energy weapons designed for use against space targets, might also be used against earth based targets.[11]

This possibility raises some very serious questions in relation to our National Space Policy. Would the US consider the deployment of a space based weapon, capable of striking the US mainland, as well as our space assets, a "peaceful" use of space? If not, how could we consider our deployment of such systems as peaceful? Could deploying such systems create a new arms race in space? These questions are extremely difficult and place the US in a paradox. Without space weapons (ASATs), space control can never be effective, but weaponizing space may violate our own National Space Policy and create new world instabilities. This incongruence is the source of the space control dilemma. The political leadership must make a determination as to whether our national interests warrant changing our Space Policy to pursue weapons in space, or if space control should be sacrificed as an incompatible tool of national security. If a decision is not made, the military will be left supporting a mission without the proper tools or doctrine to pursue it.

Notes

[1] Department of Defense, *Joint Pub 1: Joint Warfare of the Armed Forces of the United States*, 10 January 1995, I-3.

[2] Department of the Army, *Field Manual 100-5: Operations*, June 1993, 1-1.

[3] Department of the Air Force, *AFM 1-1: Basic Aerospace Doctrine of the United States Air Force*, March 1992, *v*.

[4] Col Dennis M. Drew, USAF, and Dr Donald M. Snow, *Making Strategy* (Maxwell Air Force Base, AL: Air University Press, 1988), 163.

[5] AFM 1-1, 5.

[6] Steven R. Peterson, *Space Control and the Role of Antisatellite Weapons* (Maxwell Air Force Base, AL: Air University Press, 1991), 13.

[7] AFM 1-1, 6.

[8] Major Thomas A. Torgerson, *Global Power Through Tactical Flexibility—Rapid Deployable Space Units* (Maxwell Air Force Base, AL: Air University Press, 1994), 25.

[9] Ibid.

[10] President of the United States, *US National Space Policy*, Washington D.C., 19 September 1996.

[11] Lt Col Michael R. Mantz, USAF, *The New Sword: A Theory of Space Combat Power* (Maxwell Air Force Base, AL: Air University Press, 1995), 21.

Chapter 3

Technology

> *Man has always sought to expand his domain. In subduing the earth, man moved onto the water, under the water, into the air, and into space as technology allowed. With him, man took war. Man will take war into space. It is not a matter of if; it is merely a matter of when.*
>
> —Lt Col Thomas Eller and Maj Charles Friedenstein, 1981

Technology has always been critical to waging war. The tank, the airplane, and the ICBM all played critical roles in the evolution of warfare. Not only technology, but the technological margin over the adversary is key to dominating the battlefield. Military space systems must be developed which are lethal to the enemy yet survivable against enemy attack. For space control, these systems must go directly to supporting the elements of surveillance, protection, and negation.

As previously discussed, the US currently lacks a viable ASAT capability. While the US and Former Soviet Union (FSU) have spent billions of dollars in the research of ASAT weapons, few systems have ever been deployed. Initial ASAT development began in the mid-to-late 1960's and concentrated on the use of ballistic missiles to detonate nuclear warheads in space. Because of the inaccuracies with the missile guidance of the day, nuclear weapons were believed to be the only method for ensuring target destruction. Due to the large radius of effect, it was possible to destroy numerous satellites with a single detonation. Most satellites would be destroyed by the system generated

electromagnetic pulse (SGEMP) which could instantly generate an electromagnetic field of a million volts per meter in all nearby satellites.[1] Those satellites not destroyed by SGEMP would likely be destroyed by the X-ray and gamma radiation effects.[2] While the use of such devices for ASAT weapons are unlikely today, it does demonstrate the minimal technology required to negate satellite operations. With continuing nuclear and ballistic missile proliferation, the US may some day find itself threatened by just such a system.

More conventional ASAT testing began as early as 1968 with the Soviet Union's test of a co-orbital ASAT. This weapon was designed to intercept a target satellite within two orbits and explode once within lethal range. Interception was accomplished through a system of infrared sensors, and destruction through the use of a simple chemical explosive.[3] The explosive sent pellets and shrapnel into the target satellite thereby disabling or destroying it. The system was estimated to have a range of 5000 kilometers but was intended for high priority targets in low earth orbit.[4]

With improvements in missile guidance and technology, the US began development of a Miniature Homing Vehicle (MHV) ASAT.[5] Unlike the Soviet's system, this device had no warhead and relied on a system of highly accurate infrared telescopes to guide the missile in for a direct impact.[6] Termed a kinetic kill weapon, this system was successfully tested using an F-15 for the launch platform. Although the technology was proven viable, budget and treaty considerations resulted in its ultimate cancellation.[7]

Space mines are another conventional ASAT capability which is considered extremely viable. These mines would operate in a similar manner to sea mines. They would be placed in space near target satellites and detonated from the ground. These devices could

be placed in space years before hostilities and lay essentially dormant until activated by ground control. In periods of rising tension, they could be activated and placed near critical command, control, and communications satellites. Should hostilities break out, the mines could be detonated.[8]

Most recent ASAT research has been in the advanced weapons arena. Currently both the US and FSU are conducting extensive research into areas of lasers, particle beams, plasma weapons and kinetic energy weapons. These platforms can be either space based, air based or ground based and provide a wide range of ASAT and ABM defense. While no full scale testing has been conducted against satellites, small scale testing has shown the technology to be well developed. An example is the Airborne Laser Laboratory. This experiment mounted a laser in a C-135 transport plane and effectively demonstrated the ability to destroy air-to-air missiles.[9] Demonstrating that lasers could be packaged to minimize weight and size, the success has resulted in a follow-on program to begin testing in 1999. This new program will mount a laser in a Boeing 747 and will attempt to destroy theater ballistic missiles.[10]

Another promising technology is the kinetic energy weapon. Originating as part of the Strategic Defense Initiative program, this research originally concentrated on ballistic missile defense. As a spin-off, this research can effectively be used to produce ASAT weapons. Deployed from space using a chemically propelled interceptor or from the ground via electromagnetic rail gun, these weapons fire super-hard projectiles at hypervelocity speeds.[11] Target destruction is accomplished by direct impact. While no full scale satellite testing has been conducted, small scale demonstrations have verified the technology. The Homing Overlay Experiment successfully demonstrated a ballistic missile

intercept by a ground launched chemically propelled interceptor. The target had been launched from 4000 miles away and the speed of the interceptor was 20,000 miles per hour at collision.[12] Additional successes have occurred in demonstrating the feasibility of hypervelocity launchers and the use of high-g projectiles.[13]

While it has been shown that the development and deployment of space based weapons is certainly technologically feasible, it is a matter of politics which determines their eventual utility. In the current political and fiscal environment it is the political administration which must weigh the cost of deploying or not deploying a space control architecture. Money used in achieving space superiority must be weighed against money for domestic or conventional force programs. Additionally, the US must determine how employing such a system would impact the network of treaties between the US, the FSU, and the rest of the world. Currently, these treaties seriously limit the active systems which might be employed.

Notes

[1] Thomas A. Howarth, III. *The Impact of Space on Future Wars; or, Will World War III be Waged in Space?* (Newport, RI: Naval War College, 1989), 9.

[2] Lyn Dutton et al., *Military Space* (McLean, VA: Brassey's Inc., 1990) 157.

[3] Bhupendra Jasani and Christopher Lee, *Countdown to Space War* (Philadelphia, PA: Taylor and Francis Inc., 1984), 63.

[4] Howarth, *The Impact of Space on Future Wars; or, Will World War III be Waged in Space?,7.*

[5] Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945-84* (Ithaca, NY: Cornell University Press, 1985), 207.

[6] Dutton et al., *Military Space*, 159.

[7] James K. Eken, *Roles and Missions, Doctrine, and Systems Development and Acquisition: Today's Decisions Affect Tomorrow's Space Force Capabilities* (Maxwell Air Force Base: Air War College, 1995), 10.

[8] Jasani, *Countdown to Space War,* 67.

[9] Harry Waldman, *The Dictionary of SDI* (Wilmington, DE: Scholarly Resources Inc., 1988) 6.

[10] Department of the Air Force, *Air Force Executive Guidance*, October 1996, 9.

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[11] Lt Col Michael R. Mantz, USAF, *The New Sword: A Theory of Space Combat Power* (Maxwell Air Force Base, AL: Air University Press, 1995), 21.

[12] Waldman, *The Dictionary of SDI*, 73.

[13] Ibid., 83.

Chapter 4

The Politics of Space Control

> *Therefore, like it or not, space is a new theater of war that must be studied in that regard as thoroughly and carefully as any other lest we suddenly find ourselves confronted by the threat of physical force and violence from others who have taken it quite seriously.*
>
> —G. Harry Stine, 1981

While technology and doctrine determine the eventual effectiveness of space control, it is the national leadership which determines its eventual implementation. If from previous discussions it is concluded that weaponizing space makes space control possible, then the political establishment is the key to determining its feasibility.

The military instrument of power is only one tool used by the national leadership to enforce our National Security Strategy and protect our vital interests around the world. Depending on the strategic environment, the economic, diplomatic and information instruments of power can be more effective than the military in securing US interests. During the cold war years, fear of war with the Soviet Union dominated US attention. The military was the predominant tool of security and space based weapons were the solution to the Soviet ICBM threat. The collapse of the Soviet Union rapidly changed this scenario. With the strategic environment transition from a bipolar to multipolar world, the threats to US interests have significantly changed.

While space control remains a desired objective of both the military and the political administration, the probability of obtaining the required support is highly unlikely. As has been discussed, weaponizing space is required for effective space control, but the issues of the day make implementing such a policy difficult. Two issues stand out which make weaponizing space impractical for our political leadership; budgets and treaties.

Budgets

With the end of the cold war and the collapse of the Soviet Union, the US has begun to focus inwardly to repair the damage inflicted by the cold war years. While neither the US or the Soviets suffered the physical damage typical of war, both sides suffered enormous economic damage. In the Soviet case, the damage was extensive enough to cause the collapse of the country and dissolution of the Union. The US, while not as severe, is running the highest debt in history with continual yearly budget deficits adding to the problem. In an effort to restructure the budgetary process, broad cuts are being implemented from domestic welfare to military defense. With the fear of global war fading into the past, it is unlikely that large military expenditures will be tolerated by the public or the administration.

With the new emerging world leaders being economic powers rather than military, the US must concentrate on its economic growth if it wishes to retain its superpower status. Trade agreements and partnerships are becoming the alliances of the new world order. While the military will remain a crucial instrument of power, large standing militaries will no longer be cost effective. The days of spending large portions of the national budget on

defense have ended. With space based weapons research extremely costly, it is unlikely that future budgets will allow the near term weaponization of space.

In the past, employment of weapons systems have hinged on the technological ability to develop them. In the future, employment of weapons systems will not be constrained by technology, but by budgets.[1]

Treaties

Currently, the US is a signatory on two treaties which impact our ability to pursue a policy of space control through the weaponization of space. The Anti-Ballistic Missile Treaty as well as the Outer Space Treaty place serious political limitation on our ability to deploy the necessary systems to maintain positive control of space.

The 1967 Outer Space Treaty sets the precedence for maintaining space as a peaceful environment by placing limits on the future military use of space. Several significant principles included:

1. partial demilitarization of space and total demilitarization of celestial bodies
2. retention by states of sovereign rights over space objects launched, and
3. the international responsibility of states for national activities in space, including liability for damage caused by space objects.[2]

While there is no particular reference to anti-satellite systems or other active weapons systems, throughout the document the overriding theme focuses on the "…use of outer space…for the benefit and in the interest of all countries…", that "outer space...is not subject to national appropriation...by means of use or occupation…", and to "…promote international cooperation in the exploration and use of outer space…".[3]

These statements do not lend themselves readily to the weaponization of space. While employing weapons in space may not be a direct violation of the treaty, it is a

violation of its intent. This is an issue which the current administration has chosen not to test.

The other treaty which limits the military use of space is the 1972 Anti-Ballistic Missile Treaty. This agreement was entered into by the US and USSR in an effort to stabilize relations during the cold war and reduce the possibility of nuclear war. Under this agreement, both nations agreed not to "develop, test or deploy space based ABM systems or components which are sea based, air based, space based, or mobile land based".[4]

While the Reagan Administration interpreted the treaty in such a way as to allow work on the SDI program, the Clinton Administration has taken a strict interpretation of the treaty and has determined that space based weapons can be construed as a violation of the treaty. While the treaty makes no mention of anti-satellite weapons, the use of space based lasers or kinetic energy weapons in an ASAT role may have a dual use capability as ABM defense. In an effort to avoid such controversy, the Clinton Administration has elected not to pursue space based weapons. While the ABM treaty does allow for withdrawal by a party if "extraordinary events" justify such action, the national decision to break international law, or dissolve bilateral treaties, could have serious national security repercussions. These repercussions could range from international condemnation to a full blown arms race in space. To avoid such problems, the current administration has chosen to adhere not only to the "letter" of the treaty, but also the intent.[5]

Notes

[1] Richard P. Davenport, *Strategies for Space: Past, Present and Future* (Newport, RI: Naval War College, 1988), 34.

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[2] Thomas A. Howarth, III. *The Impact of Space on Future Wars; or, Will World War III be Waged in Space?* (Newport, RI: Naval War College, 1989), 12-13.

[3] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies,* Signed 27 January 1967, Entered into force 10 October 1967.

[4] *Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitations of Anti-Ballistic Missile Systems*, Signed 26 May 1972, Entered into force 3 October 1972.

[5] Howarth, *The Impact of Space on Future Wars; or, Will World War III be Waged in Space?*, 11, 14.

Chapter 5

Additional Problems

Commercialization of Space

While the original battle for space domination took place between the Soviet Union and the United States, in the last two decades, a myriad of additional countries have jumped on the space bandwagon. In an effort to exploit the military and economic benefits associated with space, countries such as Japan, China, Pakistan, India, France, and Israel, to name but a few, have either developed their own launch capability or have entered into agreements with other countries to share capabilities. All of these countries have already, or will in the near future, launch payloads carrying communications, weather, surveillance and reconnaissance satellites.[1] These new space-faring nations are rapidly learning to use space to increase their national security as well as boosting their economies.

Even multinational corporations (MNCs) have become major players in the commercial development of space. With the number of actors capable of placing assets into space increasing each year, the quest for space domination has become increasingly more difficult. The commercial uses of space with their economic potential have grown

exponentially. As long as the potential exists for making profits in space, MNCs will continue to expand their share of the space market.

The leader in commercial space launch is currently European Space Agency's (ESA) Arianespace. With a history of reliability combined with reasonable pricing, they control nearly sixty percent of the open market.[2] They have managed to maintain a consistent launch backlog of over 30 satellites, most of which are commercial assets.[3] They have consistently out-launched both McDonnell Douglas and General Dynamics, two of the prime launch contractors for the US.[4] When looking at the cost of heavy lift launch, the US Space Shuttle and Titan IV can cost anywhere from $500 to $750 million, whereas the ESA estimates the cost for their equivalent launcher, Ariane 5, to be around $130 million.[5] It is obvious from these statistics that with current budgetary constraints, if the US desires the ability to control space, it must find a way to make launching assets into orbit more cost-effective.

Commercial assets add a new complexity to military endeavors in space. While not designed for military purposes, high resolution imaging satellites owned by MNCs do have significant military applications. Because MNCs are in business to make money, the use of such assets may be rented or sold to anyone willing to pay the going rate. This could include nations seeking information of a military nature. With the line between the commercial and military use of space blurred, the US desire and ability to control space becomes ever more complex. Numerous questions arise from this situation. One such question is: If our military adversary is buying time on a commercial satellite to target our forces, is that satellite now a legitimate target? This has numerous repercussions. If we don't target the satellite, it gives our adversary a sanctuary to continually gain military

intelligence. However, since the satellite is not owned by the adversarial nation, destroying it may broaden the conflict to include the owning nation. Article VIII of the Outer Space Treaty, in essence states that satellites launched into space are considered a sovereign part of the nation which owns it. Therefore, hostile actions to disrupt or destroy another nation's satellite may be considered an attack on the sovereign territory of that nation and possibly an act of war.[6] This scenario also applies to space assets launched as part of a multinational consortium. If we are at war with one of the nations owning the satellite, can we destroy it without affecting the interests of the other nations with ownership rights? There are numerous such questions which must be asked, however, the answers to the question may not be readily available. It must be realized that the commercialization of space, and the increase in the number of nations capable of participating in the benefits of space, dramatically complicates the US' ability to control that environment.

Soldier vs. Civilian

An additional problem which must be addressed is one of the blurring between civilian and soldier. In traditional warfare it has always been fairly easy to distinguish the combatant from the non-combatant. In relation to space, this has become increasingly more complex. While it is a nation's duty to minimize civilian casualties by separating civilians from soldiers, space appears to be an exception. Currently NASA, a civilian institution, is the nation's leader in manned space flight technology. Using the Space Shuttle program, NASA incorporates both military and civilian personnel in its operations. The Shuttle, however, is not strictly commercial or military. It has been used to launch

and repair both types of assets. In a hypothetical war scenario, if a military satellite is deemed a legitimate target, then shouldn't the logistics support for that satellite also be considered a legitimate target? A case in point is Desert Storm. Not only were Iraqi military personnel and equipment used for operations targeted, but anything used to support those operations were also targeted. If this were expanded to the space environment, then not only would a military satellite be a target, but the astronauts used to repair the satellite, the Shuttle used to support the astronauts, and the space station used to support the Shuttle would all be considered legitimate military targets.

While Article V of the Outer Space Treaty refers to astronauts as "…envoys of mankind in outer space…" and states that "in carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other State Parties."[7] It is unlikely that the treaty envisioned astronauts taking part in military affairs. Whatever this scenario implies, it must be understood that the mission of space control and the lack of distinction between civilian and military players in space only complicates our ability to achieve space control and opens us up to numerous attacks upon both our military and civilian space institutions.

Technology Proliferation

The US has long been concerned about the growing proliferation of weapons and technology around the world. While the original concern focused around nuclear weapons or other weapons of mass destruction, this focus has broadened to include numerous high technologies and dual use products which may be used in the development of space programs and increased access to space. Dual use products include those items which

have both a commercial and military use. High speed computers and fiberglass composites are examples of such dual use technologies. The spread of these technologies to third world nations jeopardizes national security and complicates the US ability to control space.

While the 1991 collapse of the Soviet Union marked the end of the cold war and the struggle between the superpowers, it also brought about a new era of instability. The disintegration of the Soviet Union has reduced the likelihood of a full scale nuclear war, but it has destabilized our ability to control the proliferation of nuclear weapons and associated space technologies. Thirteen new republics have risen from the dust of the FSU, each with their own economic, political, and military objectives, and each with the weapons and technologies left over from the cold war. All of these republics are suffering the growing pains of independence. With domestic problems ranging from economic, to political, to ethnic, these new governments are in disarray and searching for solutions. One such solution lies in leveraging their weapons and space technology for capital investment. The solution to most of their instability lies in economic reform. New money and capital is needed to rebuild the nation and jump start the economy. The US fears that sales of weapons and space technology to third world countries will be used to finance this reconstruction.[8] The proliferation of such technologies could seriously impact US national interests.

In addition to the weapons and technology proliferation brought about by the break up of the FSU, the science personnel who developed such systems also pose a problem. With most of these scientists and technicians unemployed following the national breakup, their knowledge and skill may be sold to the highest bidder. The spread of these scientists

throughout the third world could have more serious repercussions than the sale of the weapons and space systems they developed.[9]

Throughout the cold war years, the US focused on the FSU as the sole threat to their space systems. While the US attempted to counter Soviet advances, other countries were making rapid strides in developing space programs. China, Japan, and France have proven themselves capable of taking part in developing and launching space assets. Even third world countries like Pakistan and India are developing viable space programs.[10] As an example, Iraq's 1989 test of the Al-Abid space launch vehicle is evidence of the third world's advance in space technologies and systems.[11] Many of these advances were facilitated by intentional FSU technology transfer. China and India are recipients of such assistance: the Chinese through direct Soviet assistance, and the Indians through the sale of liquid-fueled rocket motors. These technology transfers eventually trickle down to other third world nations. The Chinese assistance to North Korea is such an example.[12]

One of the difficulties facing the US following the Soviet disintegration is treaty enforcement and applicability. Many of the bilateral treaties between the US and FSU were designed to reduce the risk of nuclear escalation and the possibility of nuclear war. With the threat of nuclear war diminishing and the Soviet Union extinct, have these treaties outlived their usefulness? Currently, the Anti-Ballistic Missile treaty places serious constraints on the US ability to conduct research, development, and deployment of space based weapons. As discussed previously, while there is no direct prohibition against anti-satellite weapons in space, such weapons usually have a dual use capability as ABM systems. Such a system may therefore be considered in violation of the ABM treaty. While US hands are tied to treaties with a non-existent state, other nations of the world

are proceeding at full speed with their space programs. While the US still retains a technological advantage over most of the world, "technology associated with space based weapons is not overly sophisticated, and is at least as prone to proliferation as nuclear technology."[13]

With the assurance that technology proliferation will continue and that the US dominance in space will increasingly be challenged, US policy makers must decide whether or not to pursue a space based weapons policy. The current treaties, while politically sensitive, do not perform the function for which they were intended. Unless the US gets back in the "race for space", it is unlikely that a policy of space control can be achieved with long standing results.

Notes

[1] Steven R. Peterson, *Space Control and the Role of Antisatellite Weapons* (Maxwell Air Force Base, AL: Air University Press, 1991), 39.

[2] James K. Eken, *Roles and Missions, Doctrine, and Systems Development and Acquisition: Today's Decisions Affect Tomorrow's Space Force Capabilities* (Maxwell Air Force Base: Air War College, 1995), 8.

[3] Ibid.

[4] Ibid.

[5] Ibid.

[6] Thomas A. Howarth, III. *The Impact of Space on Future Wars; or, Will World War III be Waged in Space?* (Newport, RI: Naval War College, 1989), 13.

[7] *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*, Signed 27 January 1967, Entered into force 10 October 1967.

[8] Major Thomas A. Torgerson, USAF, *Global Power Through Tactical Flexibility--Rapid Deployable Space Units* (Maxwell Air Force Base, AL: Air University Press, 1994), 27.

[9] Ibid.

[10] Peterson, *Space Control and the Role of Antisatellite Weapons*, 39.

[11] Torgerson, *Global Power Through Tactical Flexibility--Rapid Deployable Space Units*, 27.

[12] Ibid.

[13] Tommy C. Brown, *Violating the Sanctuary - The Decision to Arm Space* (Fort Leavenworth, KA: School of Advanced Military Studies, 1994), 40.

Chapter 6

Conclusions

> *[space] may hold the key to our future on earth...[no one] can predict what the ultimate meaning will be of the mastery of space.*
>
> —President John F. Kennedy, 1961

The world is becoming an increasingly complex place. While advances in technology make the world a smaller place and bring the "global neighborhood" closer to reality, they also increase tensions brought about by the clash of conflicting cultures and values. The threat of nuclear war has diminished, but new threats to US interests are continually emerging. As the new world order continues to form, there is no doubt that the use of the military instrument of power will continue to be essential in protecting US interest both at home and abroad.

In an effort to ensure its role in the emerging strategic environment, the US has focused on space as the medium to exploit. With the economic and military benefits available through space, the US has determined that assured access to space during peace, and control of space during war, are critical to securing US interests. In support of these objectives, the Air Force has declared space control as a principle military mission.

As discussed throughout this paper, effective space control requires three elements: sound doctrine, technology, and political resolve. Currently, space doctrine is severely

lacking. The little doctrine which incorporates space, does so by using airpower principles. This faulty analogy dilutes the unique capabilities of space and reduces the potential for effective space operations. Unique doctrine needs to be developed for all operations in space.

The last two elements of space control, technology and political resolve, work against each other for zero net gain. While the technology exists to employ the necessary systems to implement space control, the political resolve needed to authorize their use does not. Space based weapons (ASAT systems), designed to protect friendly systems and negate enemy systems, must be used for effective space control. These weapons, however, are a politically sensitive issue. The US policy of "equal access to space" and "peaceful development" does not lend itself readily to the weaponization of space. Additionally, the Outer Space and ABM Treaties limit the political administration's flexibility concerning the development and deployment of space based weapons. The US could alienate itself from the international community if such a policy were authorized. In these times of increased world trade, such alienation could be economically devastating. With US domestic issues focused on economics, the decision to weaponize space could be political suicide. Space control, while technologically possible, is politically not feasible.

In today's environment, the Air Force cannot control/dominate space. The primary reason is the lack of political will. The technology exists, and doctrine can be developed, but until the political administration is willing to embrace it, effective space control can not be accomplished. The Air Force is then left in a difficult situation. It finds itself responsible for a mission that is unsupported.

The US will continue to take advantage of the economic and military benefits of space, but the Air Force objective of controlling space will remain unrealized until the decision is made to employ active measures to truly weaponize the heavens.

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